Linguistics 333: Human Language and Animal Communication Systems

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LING 333 meets MWF from 2:00 to 2:50 in Dey 304. My office hours are W 12:00–2:00 in Dey 326, and naturally I'm also available by appointment. You can reach me by email at `moreton@unc.edu`, or by phone at 843–2101. Course materials on-line will be linked to from the class website[1] or Blackboard[2].

1 Course contents

Linguistic theory asks why human language is the way it is, and not some other way. This course explores a range of "other ways" found in nature. We will compare human language with the communication systems used by other animals, with special focus on natural acoustic communication in humans, birds, and non- and pre-human primates.

The first part of the course will concentrate on the *anatomy* of the sound-producing organs in these species, and on the acoustics of the sounds produced by them. Students will learn how to record, manipulate, and measure sound files using the Praat software (freeware used in phonetics labs around the world), and the basics of interpreting sound spectrograms. We will read research papers in which the principles covered in this section are used to reconstruct the vocal abilities of extinct human relatives, such as Neanderthals, from fossils.

Next, we will turn to the *structure* of communication systems. Some species have a small, fixed vocal repertoire; others, like humans, titi monkeys, and Bengalese finches, can produce a very large number of utterances by combining smaller units according to rules. What are these rules like in other species, and how do they compare with the rules used in human language? We will approach this question using concepts from formal language theory.

The last part of the course focuses on how the different systems convey meanings, and how these systems are acquired by their users. We will look especially closely at two controversial and intertwined questions, the *innateness* and *evolution* of communication systems.

A textbook for this course has yet to be written. We will rely instead on chapters from textbooks in linguistics, zoology, and other fields, combined with original research reports. Readings will be available through Blackboard or the World Wide Web.

[1] `http://www.unc.edu/ moreton/Ling333/333main.html`
[2] `https://blackboard.unc.edu`

To get direct experience of what we're reading about, the course will include a substantial lab and field component consisting of homework assignments and a major semester project. The project will involve making and analyzing field recordings of the song of the American Robin.

2 Prerequisites

The only prerequisite for this class is Linguistics 101, Introduction to Language, or the equivalent. A knowledge of high-school algebra is assumed.

3 Course requirements

Final grades for the course will be calculated as follows:

Attendance and participation	10%
Homework (problem sets and labs)	35%
Exams (three)	30%
Final field project	25%

Attendance and participation: Students are supposed to come to class, do the assigned readings on time, and participate in class activities and discussion. Missing classes will make it hard to keep up. It will also lower your participation grade (unless due to illness or other unavoidable events, which it is your responsibility to document).

If you miss a class, it is your responsibility to get missed materials from me or other students. Always check the website if you have been absent.

Students are expected to come to class having done the readings and listened to the assigned audio files. If I start getting the impression that people aren't doing the readings, I'm going to institute pop quizzes. These are annoying because they waste class time, but coming to class without having done the reading wastes even more class time.

Homework: Homework includes problem sets and labs, of which there will be about 6. You'll get detailed information about each one when it's assigned, but there are some general points that apply to all of them.

When you hand in homework, it can be handwritten, word-processed, or even typed, but it has to be (1) neat, (2) legible, (3) on paper, and (4) well-organized. Homeworks handed in on time will be graded on a scale from 1 to 3 in a way that will be explained along with each assignment using a device called a *grading rubric*. Other homeworks will receive a zero.

Exams: There will be two midterms and a final, all in class, all cumulative from the first day of the course.

Final project: To get direct experience of animal-communication research, we will investigate the combinatorial structure of the song of the American Robin (*Turdus migratorius*). Robins are common around Chapel Hill, easy to recognize, and voluble. Their song is complex enough to be interesting but not so complex as to be unmanageable in a semester project. Best of all, hardly anything is known about it. We will formulate a research question, then design, execute, and analyze a field experiment to answer it, and finally present the question and the results to the class. This will take place in several steps, and I'll be giving details as each one comes up.

4 Curricular requirements fulfilled by this class

This course is a General Education course, and fulfills the Social Science (SS) and Quantitative-Intensive (QI) requirements. It is also part of the "Evolution" course cluster.

5 Honor Code

The Carolina Honor Code is in effect in this class, and I will treat violations seriously. If you haven't read it, it's at `http://instrument.unc.edu`. If you have questions about interpretation, you should bring them to me. Everything you hand in must be accompanied by a signed statement that you have complied with the requirements of the Honor Code in everything relating to that work, e.g., "We completed this assignment in full compliance with the Honor Code."

6 Partnerships

Most of the assigned work in this class will be done with a partner, for a shared grade. There are several reasons for this.

One is purely practical. The final project is going to take more work than one person can reasonably be asked to do, so you will have to work with someone in order to finish the project on time and do a good job. But, the final project shouldn't be the first time you and your partner work together. Collaboration on homeworks during the first part of the semester gives you the opportunity to get the bugs out of the partnership.

Another reason is pedagogical. Again and again throughout the semester, each of you is going to find yourself having to explain something to your partner. Both of you will understand it better as a result.

Finally, this is how real research is done! You work with other people, share the ideas, share the labor, spot opportunities or mistakes that the other person overlooked, present the results together, and share the credit (or ignominy). It's none too early to start getting used to this aspect of research culture.

I will be assigning partners, on the basis of questionnaires, to insure that there is a fair distribution of skills and backgrounds among the partnerships. It is your job to insure that there is a fair distribution of work within each partnership. For the final project, this is mandatory: your project proposal must include an account of how you have agreed to divide up the work. Explicit agreements are not required for the homework, but informal ones are a darn good idea. Partners will work together on the homeworks and the final project, but not on the in-class exams. Partners are jointly responsible for handing in the assignment; that is, if it doesn't show up on time, it counts against both people.

7 Collaboration and citation

You and your partner are encouraged to discuss assignments with others in the class, but each partnership must write up its assignment independently. If you use any reference materials that aren't officially part of this course, you are required to list them in the write-up. (There's no shame in using them – you're just supposed to give them credit, and let anyone reading your work know where they can find the same information you used.)

8 Late-assignment policy

As a general rule, no late assignments will be accepted for credit. Exceptions may be made if

(1) You got advance permission (by asking me before the due date) to hand an assignment in late.

(2) You couldn't come to campus on the day the assignment is due because of a serious illness or other unexpected emergency. You need to get the assignment in at the earliest possible opportunity with a written explanation of the situation. Email is best, because it's fastest.

Again, partners are jointly responsible for getting things in on time, so (1) and (2) are contingent on your partner's also being unable to hand in the assignment.

9 Equipment and software

You're going to need a computer for this course. You will be installing downloaded software. If this is a problem for you, come see me at once.

Audio equipment: Most assignments (including the "reading" assignments) will involve listening to audio files, either from Blackboard or on the Web. You'll hear better if you have a pair of headphones or earphones. The kind used with portable tape/CD/MP3 players are fine. The headphones will plug into the headphone or speaker jack on your laptop or desktop computer.

To record, you'll need a microphone. For recording humans, each partnership will be issued with a mike that plugs into your computer's sound card. For making field recordings of birds, we'll be using more sophisticated equipment which can be signed out from the Linguistics Department.

Speech analysis software: Thanks to the generosity of the Government of the Netherlands, a very nice speech-analysis package called Praat is available free for download from the Institute of Phonetic Sciences in Amsterdam.[3] There are versions for PC, Mac, and Linux. I'll be handing out details on how to download and install it.

State-machine simulation software: We will be using the JFLAP simulator[4] to build automata which simulate the formal structure of human and non-human communication systems. It, too, is available for PC, Mac, and Linux, and I will provide instructions on how to install it when the time comes.

A mirror: Once or twice I'll ask you to bring a small mirror to class, for observing your articulators. The best kind is the folding pocket mirror, the kind which has a regular mirror and a magnifying mirror hinged together (so you can see around corners). However, a plain old hand mirror is fine.

[3] `http://www.praat.org`
[4] `http://www.jflap.org`

10 Approximate weekly schedule

1. Beginning acoustics. Installing and using the Praat software. ?.
2. The source/filter theory of phonation. Resonances of a half-open uniform tube. ?, ?.
3. Formants and vocal-tract length. Sexual dimorphism in elk and humans, and its evolutionary adaptive significance. ?, ?, ?.
4. Human vocal anatomy. Perturbation theory. Acoustics of vowels. ?, ?.
5. Comparative primate vocal anatomy and physiology. Evolution of the human vocal tract. Vocal capabilities of extinct human relatives. ?, ?, ?, ?, ?, ?.
6. Vocal anatomy and physiology in songbirds. ?, ?, ?, ?, ?, ?, ?. **Midterm 1**.
7. Combinatorial structure. Finite-state machines. Installing and using JFLAP state-machine simulator. Finite-state syntax in birdsong. ?, ?, ?, ?, ?, ?.
8. Structure of birdsong. First-order Markov processes. ?, ?, ?, ?, ?, ?.
9. Combinatorial structure in the vocalizations of non-human primates. Compositional semantics. ?, ?, ?, ?, ?, ?.
10. Finite-state aspects of human language. Inadequacy of finite-state machines for human language. Context-free phrase-structure grammars, and *their* inadequacy. ?, ?, ?, ?, ?, ?.
11. **Midterm 2**. Recording birds in the field. Universal Grammar hypothesis, and the problem of innateness. ?, ?, ?, ?.
12. Wholly innate songs in birds and primates: Tyrant flycatchers, gibbons and siamangs. Songs of interspecies hybrids. ?, ?, ?.
13. Sensitive periods in the acquisition of birdsong and human language. Validity of the "argument from the poverty of the stimulus" in human language acquisition. ?, ?, ?, ?, ?, ?, ?, ?, ?, ?, ?.
14. Evolution of human language structure: Hypotheses and evidence. The FOXP2 gene and the "human revolution". ?, ?, ?, ?, ?, ?.
15. Final-project presentations.

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